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Cost Accounting Practice With Special Reference To Machine Hour Rate

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CLINTON HOMER SCOVELL

1876—1926

President National Association of Cost Accountants, 1925-'26.

Editorial Department Note

Those members of our Association who were privileged to attend the "Quiz" sessions at recent Annual Conventions have a lasting and refreshing memory of Clinton H. Scovell, the man and his attitude towards his profession. More than anything he loved those discussions that dealt with practical problems of cost accounting and their solution. The "give and take," to discover the soundness of principle in an argument, was a source of personal delight to him as well as an inspiration to others.

Mr. Scovell was a pioneer in the field of Cost Accounting, particularly in the analysis and devolopment of manufacturing burden. The accompanying reprint of an address which he delivered in 1913 illustrates his conception at that time of the importance of cost accounting as an aid to management; while the reprint of a letter which he wrote in January, 1926, and included in this memorial booklet, expresses his opinion of the present-day use and further trend of cost accounting. In this letter, written nearly thirteen years later, he reiterates the importance of cost information as a guide to management, which he had expounded so vigorously and had been called upon to defend so strenuously before the Machine Tool Builders. He also points out many of the advances that have been made in industry during these years, and largely so because of the use of the information in this manner.

Mr. Scovell was born in Manchester, N. H., July 15, 1876. After obtaining the A.B. and M.A. degrees at Harvard, he was employed in accounting work by the Great Northern Railroad and United States Smelting, Refining and Mining Company from 1904 to 1906.

In public accountancy he was with Gunn, Richards and Company, New York, during 1907 and 1908 and with Harvey S. Chase & Company, Boston, during 1909 and 1910.

In December, 1910, he organized Clinton H. Scovell & Company the name of which in October, 1916, was changed to Scovell, Wellington & Company. At the time of his death, December 31, 1926, he was senior partner of the firm which now has offices in Boston, New York, Chicago, Philadelphia, Cleveland, Springfield, Mass., Syracuse, Kansas City, Mo., and San Francisco.

One of its charter members and since its formation a director in the National Association of Cost Accountants, Mr. Scovell was its president in 1925-6, and gave unsparingly of his time and effort in the promotion of its welfare. A man of high personal and professional ideals, though often misunderstood and misjudged, he was an indefatigable worker and has left a measurable impress on his profession and, in a more intimate way, on the wide circle of his acquaintance.

COST ACCOUNTING PRACTICE WITH SPECIAL REFERENCE TO MACHINE HOUR RATE*

There is more reason now than at any other time for many years why American manufacturers should consider most carefully the problems of finance and management in connection with their business undertakings. Facing the prospect of increased foreign

*An address delivered before the annual convention of the National Association of Machine Tool Builders, Hotel Astor, New York, October 22, 1913, and now reprinted through their courtesy.

competition in some lines and the tendency towards higher wages which inevitably follows the increased cost of living, and especially the increased cost of food which makes up such an important part of workingmen's expenses, manufacturers are necessarily interested in any ways or means to make their industrial operations more efficient.

Many things contribute to the efficiency of shop management. When a business is small, its success usually depends on the ability, foresight, and good judgment of one or two energetic men. As the business grows, methods and system must more and more take the place of the manager's personal oversight, and consequently the need increases for accounting, sound in principle and simple in operation.

Under the influence of the new science of management, there has been a constant study in the last few years of manufacturing methods, operating standards, cutting speeds, etc., which has resulted many times in such marked increases of production that the management may be sure that an improvement has been made, even if it does not know exactly *how much* saving has been effected.

It has been clearly established, however, that the cheapening of manufacturing operations which is brought about by a better operating practice is frequently secured at a considerably increased cost for office force, planning departments, helpers, supervision, and other indirect labor, sometimes wrongly called non-productive. As a result the practical problem for the manufacturer is to compare the lessened direct cost for labor and equipment with the increased cost for the other factors. This he can do only when he has an adequate cost accounting practice.

It is my purpose to point out the essentials of a cost system for a machine shop or a manufacturing plant where the operating conditions are similar, with especial reference to the theory and practice of a machine-hour rate. I expect to show you that this is an intensely practical matter and that it has an important bearing on the sales policy and the general management of your business.

Classify Expense Properly—Distribute It Correctly. Good cost accounting depends on the correct application of a few well understood principles. The first of these is to have the direct charges from the original sources, that is, pay-roll and material distributions, correctly classified between direct and indirect costs, and then to determine how the indirect, or so-called non-productive charges, may be identified with the product.

Any cost accounting practice worthy of the name should record accurately the direct labor costs. In a machine shop, or under similar conditions, this direct labor cost should be applied with precision to each job going through the shop. *Very little cost accounting practice, however, has attained any similar precision for distributing the indirect charges for equipment, referred to hereafter in this article as burden.*

What Is Burden? As the difficult and important part of cost

accounting is to determine how a correct distribution of burden may be accomplished, it is clearly worth while to consider briefly the elements of burden.

It is a tedious and expensive undertaking to build and equip a new plant and to complete the cycle of manufacture from design to finished product; and there is much to gain in the way of a clear understanding of costs, if we trace out this development step by step, taking careful note of the elements of the problems as we proceed.

When a new industry is to be established, the directors first buy a parcel of land suitable for the location of the proposed shop. If the purchase price is $40,000 the new enterprise has at once absorbed capital that should earn about $2,000 to the ordinary, prudent investor, who takes no manufacturing or trading risks. A site as costly as this is probably situated in or near a city, so that it will be subject to taxes of $500 or $600.

Shop buildings are next erected at a cost, let us say of $200,000 more. This outlay of capital, like the investment in land, involves an annual interest charge (of some $10,000), and under present laws, an annual penalty of some thousands of dollars more for taxes. But, unlike land, the buildings will require constant repairs. Even then they are subject to a slow but certain deterioration and obsolescence that must be met by a charge for depreciation. To protect the investment, the owners must pay insurance and provide watchmen. To make the buildings usable, they must be heated and lighted, supplied with water and fresh air, and regularly cleaned. The striking thing about these charges is that they all go on without any abatement, unless the shop is shut down, dark and cold, and even then the principal charges—interest, taxes, insurance, repairs, and depreciation—abate scarcely at all.

All this expense has been incurred by the management to provide suitable areas for the intended manufacturing process. If there are five or six subdivisions, each one may occupy an entire small building, or all or part of a floor in a larger building. Whatever the details, each department (if we may use that overworked word) uses so many hundred square feet of floor space and must carry its proportionate share of the land and building charges already described.

Within a department there may be one or more different operations, such as, milling, grinding, boring, turning, planing, fitting, and assembling. The equipment in each case represents an investment of capital; it requires the payment of taxes and insurance; it suffers depreciation (even more rapid than the building); and it incurs charges for power, repairs, and such indirect items as superintendence, inspection, and helpers' services. If the shop shuts down, the power may be shut off and the foreman dismissed; but so long as it runs, however short handed or however inefficiently, these charges do not change materially; and the fundamentals of

interest, taxes, insurance, etc., (with the possible exception of repairs) are not one whit less.

All that has been described so far is overhead expense, more properly termed *burden*, and does not include any labor applied directly to the product (like the operative who is working at a lathe or boring mill).

This great accumulation of burden *represents manufacturing capacity*. Each department, and each separate machine-tool has a known annual burden. Its cost per hour is determined by dividing the total burden by the hours in the working schedule, and the shorter the schedule, the greater the hourly cost.

Having completed the buildings and installed the equipment, the management is ready to begin manufacturing operations. As the several parts of the machine progress from rough castings or forgings to finished pieces ready for the assembling floor, their value has increased as they have absorbed the successive increments of direct or productive labor and of the burden appertaining to the production centres through which they have passed.

Cost Accounting and Production Control. Before illustrating the practical application of this theory, I want to point out that good cost accounting is a help to efficient management, not only as it traces and records values but also as it may be made a powerful agent for production control. From my experience in professional service for industrial plants, I emphasize more and more the practical value of this second aspect of the work.

It follows, therefore, that the first step in planning a cost accounting practice for a machine shop is to consider by whom and how authority to manufacture shall be exercised. It is simple enough to order ten castings from a given pattern which has already been made, but as you all know, the production of a machine tool involves orders for castings of many different patterns and sizes, bar stock for forgings, etc., and these material orders are all very simple in comparison with the complex schedule of machine operations which are required to produce the finished parts. You all recognize how important it is that parts should be made in quantities that are economical and that the different pieces required should all be ready together on the assembly floor. It is, therefore, of the utmost importance to make effective plans to initiate and control the production so that these results may be accomplished. The management will then have a definite schedule of manufacturing operation on which costs may be determined by orders, by lots, by individual parts—with as much or as little detail as may be necessary.

What Constitutes an Adequate Cost Practice. Returning now to the subject of specific costs, the first step is to provide such labor records, preferably with good automatic time stamps, as will make possible the necessary distinction between direct and indirect operations, and the exact time devoted to each lot of material or each expense order.

The next step is to compute the burden correctly for each department, including interest, taxes, insurance and depreciation on the buildings and equipment, and the additional charges for power, supervision and repairs. In many industrial plants "manufacturing expense" includes only part of these charges. The first cost of manufacturing is plant investment—land and buildings. No management using a rented plant would think of omitting rent from overhead charges. When the manufacturer becomes also a landlord, as when the plant is owned by the manufacturing company, what sound reason can possibly be given for omitting from burden the charges which the management incurs in lieu of rent?

The equipment presents a slightly different problem. Very few manufacturers operate with rented equipment; if they do, there is rent to pay, as an unavoidable burden on the manufacturing operations. When the equipment is owned, the maintenance charges are equally unavoidable. The manufacturer must get interest on his investment before he has in any sense a profit, and he must bear the expense of taxes, insurance, depreciation, and repairs. Although these elements of cost may be neglected or not stated, they are, nevertheless, taking their proper share, or more, of what is figured without them as gross profits.

The weakness of many cost systems is that important elements of indirect cost are thrown together in a "general expense" account, concealing the leaks and wastes that reduce efficiency and curtail profits. Many manufacturers have no doubt been satisfied to handle burden in vague and general terms because they did not know any better way to dispose of it.

It may be stated confidently that under ordinary machine shop conditions, no accurate distribution of burden can be accomplished, and therefore no accurate costs determined, by spreading burden over all the work done in the shop as a percentage of the cost of direct labor. In the shop proper, with its widely varying equipment of machine tools, distribution on the basis of a man-hour rate is not very much better, although, as I shall point out later, that plan works very well for fitters and assembly men.

To secure a correct burden distribution it is only necessary to prove, by analysis, the elements of which burden is composed and then to consider how all this overhead is actually applied to the product.

Attention Should be Fixed on the Production Center. At this point we encounter another mistaken tradition of "departmentalized costs." To define burden correctly in each department is good as far as it goes, but it does not go very far, especially in a machine shop. *The attention of the manager and the cost accountant ought to be fixed on the individual production centre,* usually a power machine. Recent developments under actual shop conditions show that *the correct burden* for a machine tool *may vary from less than ten percent to over three hundred percent of a ma-*

chinist's wages. The widely accepted method of charging burden to costs on the value of productive labor makes no distinction between the mechanic at the bench, whose work has practically no burden except supervision, and the operator using a costly machine, which involves heavy charges for maintenance, power, and repairs.

Fallacy of Average Rates. Face this situation squarely and the fallacy of an average rate is exploded forever. Instead we recognize as many elements of burden as possible, and while it is not necessary or desirable to apply these elements separately to the cost of each job, it is from every point of view desirable to identify the burden with the production centers through which it is charged to the jobs. For machine tools, under this plan, there is a charge to each job for the use of a tool as specific and as definite as the charge for the wages of the mechanic who operates the tool.

Bench Hands and Assembling Crews. The work of bench hands and mechanics on the erecting floor must be accompanied by a burden charge which obviously is not literally a machine-hour rate. The burden rate for bench equipment differs not at all in principle from the rates for the machine tools. If, as is usually the case, the mechanics at the bench work under substantially uniform conditions, a uniform rate may be made at so much per hour for the use of the accommodations which they require for their work. In a large shop the bench rate might be different in different departments. Since it is uniform for all mechanics who work at the bench, it is practically a man-hour rate. It must be borne in mind, however, *that it is a rate for the use of equipment only,* unless indeed the circumstances make it convenient to merge the cost of supervision with the cost of equipment.

The erecting hands in a shop present a problem of a different kind. Their work usually requires a considerable area, and important charges for crane service and supervision. To speak of this work in terms which have long been familiar in cost accounting practice, the erecting floor may be considered as a department whose burden is to be distributed with reference to the work performed by the mechanics employed in the department. Probably the best way to distribute this burden is on a man-hour rate derived by dividing the total annual burden by the number of man-hours for the department.

General Burden. There are other charges connected with the management of a machine shop or manufacturing plant which are not necessarily well expresesd through an hourly equipment rate. Such are charges for the drafting room, the bookkeeping, cost accounting, supervision, liability insurance, and general charges of management not specifically and directly connected with the maintenance and operation of machinery. These are charges which in a small shop should be applied in a fairly uniform way over all the employees in the establishment, preferably on a man-hour basis. This charge would be known as general burden, and

since it would be uniform, it may be applied to the cost of each job, against which hours of mechanics' time have already been recorded, with very little additional work.

Why Scientific Machine Rates are Important. The successful operation of a scientific machine rate is the most important development that has occurred in cost accounting practice in a generation. As these rates may be applied to the cost of jobs, the charge for burden which hitherto has been the difficult and uncertain part of cost accounting will be as accurate as the charge for direct labor. Furthermore, the use of equipment rates, in effect *a precision method* for the important part of overhead expense or burden, requires no more work in a cost office than the application of a rate which contains only part of these charges.

There are two good reasons for saying that a scientific machine rate is a development of tremendous importance in cost accounting practice. The first is that referred to in the opening paragraph of this article, namely that it is essential when scientific management is introduced that there should be an *exact* measure of the saving which is effected by it. The literature on this subject has not thus far made a sufficient recognition of the very important fact that if an operative reduces the time on a given job from ten to seven hours, for example, he has not only saved three hours at his wage rate, but also three hours of the rate for the machine tool which he has used, and three hours of general burden. As will appear from the table annexed to this article, these overhead costs are frequently more important than the direct wage which has already received so much attention.

Cost accounting practice, moreover, which analyzes burden charges as described in the foregoing paragraphs would naturally make a very precise account of the increases in overhead expense of any kind. In some cases in connection with the introduction of scientific management, these increases would be in a particular department, and would operate to increase the burden which would be disposed of as a machine-hour rate for the tools in that department. Usually, however, the additional charges would operate to increase the general burden, which is one of the most important and at the same time, one of the most elusive elements of manufacturing cost.

A Measure of Loss Due to Slack Production and Inefficient Operation. The second reason for attaching so much importance to a *scientific machine rate* is that it *makes possible an accurate measure of the loss due to slack production or interrupted operation.* This is perhaps more important than the improved accuracy of cost records referred to above. When the board of directors is gathered at the end of the year, or once in six months, to learn about the results of the period under review, they do not often consider such detailed matters as the cost of individual orders. On the other hand, they are always interested in any explanation which

the manager has to make about losses that are due to curtailment of manufacturing operations.

The directors at such times would value more than anything else a clear statement showing *how much* their company had lost on this account, especially if the details of the statement could be readily understood and readily proved by an analysis of the operating conditions. The big problems, in regard to manufacturing, which the directors have to settle are those involved in the effort to make an efficient use of plant and equipment, especially if they are asked to decide on new additions to meet a probable volume of business. The new plant means an added investment, and it is of the utmost importance that the accounts should subsequently show to what extent this investment was utilized.

It is essential to distinguish clearly between losses or gains on machines actually made and sold, and losses due to slack production or inefficient use of equipment.

It must be borne in mind that the finished product has *absorbed only the burden of the equipment actually used in its manufacture.* It has not absorbed the burden of unused equipment or idle machinery. If the plant includes a foundry and the management decides to purchase castings, the idle foundry has contributed nothing to the product. It is obviously unfair to charge into the cost of goods the burden charges on the automatic machinery that may be idle because the management is buying and not making machine screws. If only three-quarters of the lathes run, the idle remainder have not helped machine parts actually manufactured, and although the plant may go into bankruptcy if it cannot utilize its equipment, the *cost of the work actually done is not greater on that account.*

The burden on idle machinery is no more a part of the cost of manufacture (unless due to enforced seasonal variations) than the burden on a shop owned by another corporation. When there is a proper distribution and application of expense burden, only the burden is charged to cost which represents the equipment utilized in manufacture, and burden not applied remains as a balance to be charged direct to the loss and gain account at the end of the month, six months, or a year. (See diagram, page 895.)

This is readily accomplished through the means of burden accounts which collect by a very simple bookkeeping practice all of the charges in a given class, and receive credits as burden rates of the same kind as charged to the cost of product going through the works. The unearned burden in some cases may indicate an error which is to be corrected by using a more accurate rate in a subsequent period, but when proper records have been established, *the unearned burden is a clear loss,* and the balances of the burden accounts should be transferred directly to the profit and loss account.

I have sometimes referred to the manufacture of powder to

illustrate this point. As a matter of safety the company builds small scattered plants, rather than bringing together one great manufacturing unit. If their production is to be curtailed they may shut down plants Nos. 2, 8 or 10 as the case may be. No one would contend that the cost of making powder in plant No. 3 is any greater because plants Nos. 2, 8 and 10 are shut down. A director of the Powder Company would be interested to see whether the plants as a whole run profitably, and whether they individually make a product that will sell at a profit. The corporation as a whole must suffer the losses due to idle plants.

Now that theory is just as applicable to the separate units of your plants. If you have twenty lathes in one department, you may run thirteen and shut down the other seven. You can keep out of the current cost the burden pertaining to the seven that are shut down just as easily as the Powder Company can keep the operation of the three idle powder plants out of the cost of those that operate.

Effect on Sales Policy. If the distinction is maintained between losses or gains on goods made and sold, and losses due to restricted output, the management will consider sales policies in a much more certain way than is possible when the facts are obscured in the haze of average costs, calculated on varying volumes of product. In respect to burden it is frequently true that costs figured as averages vary beyond all hope of comparison as the volume of output goes up or down.

When a cost accounting practice is maintained that distinguishes carefully between prime costs for material and labor, (which vary almost directly with the volume) and overhead charges or burden, the managers can see exactly in times of slack production at what price they can take any work that is offered and get something to carry the burden of the shop, in addition to the direct cost of labor and material. This, it must be admitted, is to some extent a matter of policy, for it may be better to hold a price and restrict output, rather than break the market by quoting prices that will give temporarily a little additional profit.

A Measure of Manufacturing Efficiency. Whatever the effect on sales policy, good cost accounting, including correct burden distribution, is a matter of enduring importance from the point of view of manufacturing. Changes in volume may completely obscure gains or losses in efficiency, and render comparative costs of similar jobs impossible from season to season, solely because of the variations in the amount of business done. Exact costs, comparable under all conditions, are not to be secured unless the burden charged to production is only that appertaining to the equipment that is actually at work.

From the manager's point of view, the significant fact is that the burden, which it is proposed to apply through a series of equipment rates, is not appreciably less when the operating schedule

of the plant is reduced. It is true that power charges may be slightly less, but the fixed charges for building space, interest, insurance, taxes, depreciation, and in some circumstances for repairs also, are no less when the machines are idle. *The manager of a machine shop cannot make a greater mistake in figuring costs than to charge a higher burden in any form whatsoever for the operation of part of his equipment, because the rest of it is temporarily idle, or a higher rate for a smaller labor force because the plant is working on part time. These differences which have always attracted the attention of observing managers are almost entirely clear loss or waste, and should be recognized as such and charged directly to the profit and loss account.*

A Practical Example. The practical manager who regards these ideas as too theoretical will do well to inspect the following list which shows the results of working out a machine-hour rate for direct operating burden in a plant operating about one hundred and fifty machines.

Number of Machines		*Rates in Cents*	*Number of Machines*		*Rates in Cents*
6	@	1.5	12	@	7.0
4	"	2.0	12	"	8.0
9	"	2.5	7	"	8.7
4	"	3.0	4	"	9.0
6	"	4.0	3	"	9.5
2	"	5.0	10	"	10.0
4	"	6.0	3	"	11.0
10	"	6.6	13	"	12.0
2	"	13.0	3	"	24
2	"	14	2	"	25
11	"	15	1	"	26
1	"	17	1	"	29
3	"	18	2	"	30
1	"	19	1	"	47
1	"	20	1	"	52
1	"	22	1	"	76
4	"	23			

If one is disposed to criticise the minute division that has been made, such as having rates at 8c, 8.7c, 9c, 9.5c, and 10c, it should be borne in mind that there is practically no more work in the cost accounting department in using five rates instead of two. Moreover, if an effort is made to combine some of these rates, it is exceedingly hard to say which rates should be raised and which should be lowered. If five rates like those mentioned above should be brought together, some of the rates would be at least 15% out of the way. Such an error is altogether too large to be tolerated unnecessarily, when one is seeking for really accurate costs.

At the plant where these rates are in force the burden for erecting hands, including the charges for floor space, crane service and supervision, was *five times the rate for bench hands.* In addition to these rates every employee participates in a general burden

which includes superintendence, managers, drafting, cost accounting, and all general charges, except those connected with selling expenses.

Inaccuracy of the Old Methods. The results which have been secured in working out these machine rates need only be stated to a practical man to show the violent inaccuracy which there must have been in cost accounting when overhead charges were applied as a percentage of productive labor, or even on a uniform man-hour basis. The following figures will supply a vivid illustration of the inaccuracy of the old method:

Job No. 1		*Job No. 2*	
5 hours labor @ 28c	= $1.40	5 hours labor @ 28c	= $1.40
5 hours burden on the average plan @ 30c	= 1.50	5 hours burden on the average plan @ 30c	= 1.50
Total cost	= $2.90	Total cost	= $2.90

At the same wage rate the two jobs show the same cost because they took the same time, although job No. 1 may have used a machine worth 3c per hour and job No. 2 a machine worth 24c per hour, or even one worth 50c per hour or more. Under these conditions, and assuming a general burden rate of 10c per hour, the true cost of these two jobs was as follows:

Job No. 1		*Job No. 2*	
5 hours labor @ 28c	= $1.40	5 hours labor @ 28c	= $1.40
5 hours machine rate @ 3c	= .15	5 hours machine rate @ 24c	= 1.20
5 hours general burden @ 10c	= .50	5 hours general burden @ 10c	= .50
Ttoal cost	$2.05	Total cost	$3.10

This is a very conservative comparison. If job No. 2 required a machine worth 60c per hour, the cost would have been $1.40+$3.00+$.50=$4.90. The percentage on labor method, or a straight man-hour rate in the shop, would show that these three jobs had the same cost, although as a matter of fact in the second case the cost was 151% and in the third case 239% greater than the first.

Perhaps the best thing that can be said about cost accounting practice by machine-hour methods is that it does not require any more work than any of the older methods that have been well developed as a means for taking out costs. At the plant from which the above illustration is drawn, it is not expected that there will be any increase in the cost accounting force for the operation of the plan as outlined. Of course, if a plant with an under-developed cost practice, or none at all, starts to make improvements in a wholesale way, it must expect to increase the overhead charges. If this increase is wisely planned, it is sure to be a money making expenditure.

INVESTMENT
BURDEN
MANUFACTURING COSTS
PRODUCT
TRADING — LOSS & GAIN
LAND
INTEREST
TAXES
BUILDINGS AND FIXTURES
INTEREST
INSURANCE
TAXES
DEPRECIATION
REPAIRS
HEAT
LIGHT
WATCHMEN
JANITORS
MACHINERY AND EQUIPMENT
INTEREST
INSURANCE
TAXES
DEPRECIATION
REPAIRS
POWER
OFFICE FURNITURE AND FIXTURES
INTEREST
INSURANCE
TAXES
DEPRECIATION
REPAIRS
RAW MATERIALS USED IN FACTORY
INTEREST
INSURANCE
SCHEDULED BURDEN — DISTRIBUTED BY PRODUCTION CENTERS DEPARTMENTS PROCESSES
DIRECT LABOR
MATERIALS AND SUPPLIES
BURDEN EARNED
DEPARTMENTS PROCESSES OPERATIONS
WORK IN PROCESS
FINISHED PRODUCT
MANUFACTURING COST OF GOODS SOLD BY CLASSES
NET SALES BY CLASSES
GROSS PROFIT BY CLASSES
SELLING AND GENERAL EXPENSES
SHIPPING EXPENSE
NEW YORK OFFICE (OR CHICAGO OFFICE)
SALESMEN'S SALARIES
COMMISSIONS
TRAVELING EXPENSE
ADVERTISING
SAMPLES
NET PROFIT ON SALES BY CLASSES
MISCELLANEOUS INCOME
MISCELLANEOUS EXPENSE
LOSS AND GAIN
UNEARNED BURDEN
DIRECT TO LOSS AND GAIN
DIAGRAM OF TYPICAL ACCOUNTS IN A MANUFACTURING BUSINESS

Mass Production and Automatic Machines. As noted earlier in this article, there are some conditions, of course, under which a machine rate cannot be used to distribute burden, *but the underlying principle of collecting all burden charges for each production center is sound, whatever method may be used for distribution.* Some operations can best use a process rate, which includes labor and accessory supplies as well as burden. This method is particularly applicable to mass production, or any work that is not made on successive and clearly distinguished manufacturing orders. The application of overhead charges, however, can be made through a process rate strictly in accordance with approved principles of burden distribution.

Automatic or semi-automatic machines present a troublesome problem of burden distribution, especially as the burden is usually far more important than the labor as an element of manufacturing cost. This problem has been handled at a plant operating several hundred automatic machines by a plan of efficiency charts, which provide for charging to the job the cost of the effective operation of the machine. Cost accounts under this plan measure with great precision the loss due to slack production or careless attention from the operator.

Conclusion. There are still some managers who do not realize the importance of a good cost and accounting practice, but the knowledge it supplies is undoubtedly a valuable business asset, as well as a powerful aid to efficient management. The best possible evidence for this statement is that progressive and successful manufacturing enterprises are making liberal expenditures for work of this character.

The present day trend of busines is undoubtedly in the direction of a more exact and scientific knowledge of every important detail. Success by rule of thumb, or from energy and enthusiasm alone, is becoming more and more impossible. "The man who knows and knows that he knows" is the man who wins.

After concluding the paper, Mr. Scovell said: "If any of you gentlemen would like to ask questions or put in some counter-fire, if it is consistent with the custom of your Convention, I shall be very glad to have you do so."

Discussion

PRESIDENT BULLARD: Mr. Scovell has given us a very interesting paper, and I thank him on behalf of the Convention. He has also suggested that we cross-examine him on this subject. I know that he would welcome any discussion that you wish to bring up; so you can be quite free with your remarks or questions. We have plenty of time at our disposal for this purpose.

MR. GEORGE I. ALDEN, *Norton Grinding Co., Worcester, Mass.*: I suppose that one object of cost accounting is adjusting the selling price of your goods. Of course where you do a jobbing business

this matter of keeping the burden on the separate machines is quite an important one; but what do you do with the unearned burden? You say that the unearned burden of the machine goes in with the cost of the product. What do you do with the unearned burden in fixing the selling price of your product is one question I would like to ask. Another object, it seems to me, of a cost accounting system, is to learn where your losses are and to try and keep up the efficiency of each one of your departments; but if you are simply manufacturing a product like lathes, planers, or shapers, a knowledge of all these details of the cost in each department and the unearned burden would not affect your profits at the end of the year, unless the details help you to get your cost less and manage your factory better. Of course if you are doing a jobbing business it is quite unfair to charge one man the same price for work on a large, expensive machine as you charge another man for work which does not require as expensive a machine. But I think so far as the cost system is of value, it must be so in helping you to reduce your real cost, which to my mind is its principal object. Another of its objects is to enable you to fix your prices so that you will know what your profits are.

I want to say in regard to the matter of charging interest, I know there is quite a difference in practice in regard to charging interest on your original investment as a part of your cost. It seems to me that there are two ways of looking at that. I presume that the way the matter was presented in the paper is correct—I think it is, in a sense. I did not hear anything said about where dividends come in in this cost accounting; but we have all got to acknowledge that under the system recommended when we get any dividends or so-called profits they will be absolutely over and above the interest on the investment. Dividends are not something to pay you interest on your investment, but they are "velvet" so to speak. I suppose a socialist might object to that view of it, but I do not object to it.

MR. SCOVELL: I think the relation of the cost of manufacture to the selling price is the very crux of the whole problem. If your production is rather slack, the profit is not very large, and the apparent costs according to the old method are distressingly high. That is usually due to a trade condition which would not give you any warrant for making a corresponding boost in the price of your product; in other words, you are perfectly sure that you cannot load on to your customer any cost of the inefficiency of your own plant. You have to sell your machines in competition with all other competing manufacturers and you have to make a price which represents in the long run efficient manufacture. Under such circumstances you will want to know the real manufacturing cost as accurately as possible. If an order comes along for twenty machines of a certain type, you want to know how much additional expense you will incur to manufacture them, so that you may wisely decide to take the order or leave it.

When you start that order through the shop it means purchases of castings, unless you have your own foundry, and it involves from one to a dozen machine operations on each part; and what you want, gentemen, is the actual cost. Most manufacturers measure out the labor cost with considerable accuracy, and if you can calculate the burden for the equipment used and the proper burden rate for the men at the bench and on the assembly floor, you may figure out the total cost just as definitely as the amounts you pay for wages. If you are so unfortunate, notwithstanding this hypothetical order of twenty machines, that you do not have your shop filled up, you have a burden of unused machines, and I think you should charge that burden direct to profit and loss. It has no relation whatever to the cost of the product manufactured. In other words, the unearned burden has nothing to do with fixing the cost of the product sold.

MR. ALDEN: What do you do with the unearned burden?

MR. SCOVELL: Charge it off to profit and loss.

MR. ALDEN: What relation does that bear to the price at which you sell your machines?

MR. SCOVELL: I do not see that it has any.

MR. ALDEN: Then you might have an unearned burden at the end of the year which would put you out of business?

MR. SCOVELL: The cost accounting should be so arranged that the unearned burden is known for each department of the business, and as frequently, at least, as once a month. The efficient utilization of the equipment, you will agree, is one of the important aspects of good management. Another point in shop practice which needs to be carefully considered is to see that each operation is done as economically as possible. Among other things, this means putting the work on the proper machine tool, and exact comparisons of this kind cannot be made unless the burden belonging to the respective tools is accurately known and taken into account in comparison with the respective labor costs, in considering one machine or another for the work. In this way, a correct cost accounting practice is an important help to more efficient work and therefore to reduced costs in the shop.

MR. ALDEN: I agree that if you want to call the cost one thing or another you may. But if you have other expenses, they must come in somewhere before you can intelligently tell for what to sell your product. You spoke of machines lying idle which would mean an unearned burden. I think there are a good many machine builders that are getting a little unearned burden at the present time. But this is not a question of today or tomorrow but largely a question year after year which tells what the product really costs. It is all very easy to say that at the end of the year you are to charge off an unearned burden to profit and loss, but is there going to be anything to balance it at the end of the year? I do not think it makes any difference what each machine does or what the burden of each machine is; all you want to know really

is the total. That is all you care for unless this other information can help you manufacture more cheaply. All this segregation of burden is beautiful enough, is very correct and all right, but it seems to me that a great deal of it is of no use, if at the end of the year you are simply going to charge it to profit and loss. It is of no use unless it helps you to manufacture the product more cheaply and keep your shop full. The machine tool business, as I see the way it now runs, has to carry an unearned burden a good deal of the time, and we want to know how we can meet it in some way when we have it. Charging it to profit and loss is all well enough in the accounting, but that is a mere matter of bookkeeping.

There is one thing helpful to me to keep in mind in connection with profits in dull times. I try to know about how much productive labor I have got to carry in the shop that the product of this productive labor may bring enough to pay expenses. When I get below that amount of productive labor I know that I am losing money. When I keep above that amount I am pretty sure that I will sell the product some time and that I will not be a loser. So that while it is all right to keep this accounting system, I think regarding unearned burden you have to know about what it is going to average, or you will not know how much you may have to charge to profit and loss at the end of the year.

MR. SCOVELL: I see there is a practical aspect of this matter of which I did not make sufficient recognition. If you conceive of your industry as one that is inevitably subject to such variations, you have to fix the price of your machines high enough so that the margin of profit between cost, as I have defined it, and the selling price will give you a surplus out of which the bad experience and unearned burden of your succeeding years can be provided for. It is necessary to qualify my remark that the unearned burden had nothing to do with fixing the price of the machine with this perfectly obvious explanation, otherwise I will not do justice to the questioner or myself.

Reference was made to dividends, and my explanation is that interest on investment should be charged into cost and credited to the current profit and loss account, and is available for dividends unless there are offsetting charges from other sources (*e. g.* product sold at a loss or unearned burden). It is essential to distinguish between the real burden used in making the product and the unearned burden due to idle equipment. When you get into a sharply competitive market it seems to me that that is the only practical theory to go on, so that you may know at just what price you can afford to take an order.

Perhaps you may say you do not care to enter into that kind of competition, but even if you do not get enough on an order to carry all the burden which belongs to it, it may be desirable to take that order if you can get back all the direct labor and material cost which you must pay out of pocket to make it, and part of the

burden, which otherwise goes on absolutely unutilized. Do I make that point perfectly clear? It seems to me that is of tremendous practical importance.

My questioner made another reference for which I thank him. Experience shows over and over again that when the bookkeeping according to the usual plan shows an apparent rising burden as production falls off, it is recognized as an unhealthy tendency, but it is not human nature for you to get after that condition and make the plans to correct it with anywhere near the energy you would if your accounting showed exactly *how much* the loss was from month to month. Nothing brings that home so definitely as dollars and cents figures representing the manufacturing capacity that you do not use.

Reference was also made to the value of a cost system in helping a management learn where the losses are and reduce the real costs in the shops. In that respect a good cost system is like a recording instrument which reports facts for the guidance of those in charge. The cost reports should cover the right kind of information, and it is especially important that it all should be very promptly available. When a cost accounting practice meets these two tests, the active manager will naturally use it extensively to secure the greater economy of production which you are all aiming at.

MR. ALDEN: When you have found this $13,400 burden, just what do you do? I mean of what advantage is the knowledge?

MR. SCOVELL: Under such circumstances you are a good deal like the man who has consulted a physician and is advised that he must get more sleep or must move to another climate. It is a practical matter. It is not for your physician to tell you how you are to go about getting more sleep, or just what plan you can adopt to move to Colorado; that is for your family and yourself to consider. So it is here when the accountant is calling shop matters to your attention, especially when you get the information every month; it is up to you as a practical business man to decide what you should do.

MR. ALDEN: It seems to me that your cost system is the answer, that it will tell you pretty nearly so that you can go right to the source where the loss seems to be the greatest, and try to remedy it. But the separation of the items does not appeal to me as of any particular value except to call attention to the aggregate loss; but the whole cost system itself enables you to keep track each and every month of where the cost of this or that part of the work is rising.

MR. SCOVELL: When you say that the separation does not appeal to you I am reminded of a murder trial now going on in Massachusetts. The victim is said to have died from arsenical poisoning. How are the jury to know that, or how many grains of arsenic were found in the man's stomach unless they have recourse

to some laboratory method to ascertain it? So you must rely on laboratory methods in order to determine the facts.

PRESIDENT BULLARD: Some two or three years ago, in discussing this same problem with a prominent machine tool manufacturer, he told me that he had created a reserve fund to take care of this unearned burden. During the good times he had an overhead charge, which we will call one hundred percent normally; but he said that he applied an extra ten or fifteen percent regularly on his product during the prosperous times when his plant was running at full capacity, and from it set aside a reserve which enabled him to absorb the unearned burden during the dull times.

Now this seemed to me to be a very wise provision. The only difficulty that I see in applying it would be that it would increase our price ten or fifteen percent during the good times, and it is a question whether our product would stand it, whether the market would absorb our product at the increased price. But it is a matter of averages in the machine tool business, and we must in some way provide during the prosperous times which we sometimes have for the inevitably dull times which are coming; and our profits would have to be sufficient during the good times to do it.

As I understand it, Mr. Scovell's method of overcoming our difficulties by his cost system is simply to point out to us our weakness through so keeping the cost that we can intelligently create a sufficient reserve during the good times when it is possible to do it in order that, when the dull times come, we can have the reserve to fall back on and feel that we can absorb our unearned burden thereby. This reserve would be in the profit and loss account whether you had kept a record of it or not. It would be desirable, I would say, to know that it is there. Now what is to put it there? It seems to me that the only answer is increased prices during the good times.

Is there any further discussion of this subject?

MR. R. S. REED, *Francis Reed Co., Worcester, Mass.*: You spoke of increasing the price perhaps fifteen percent during good times?

PRESIDENT BULLARD: That was merely a suggestion, not an absolute figure.

MR. REED: In case you do that would it then follow that you would establish a lower price when business was dull?

PRESIDENT BULLARD: The increased price might permit of that when it was necessary.

MR. REED: Is that a question of business policy?

PRESIDENT BULLARD: It is not a question of policy, it is a question of accounting. As I see it, increasing the price during good times would not necessarily mean to decrease the price in dull times. It would merely mean that by increasing the price we would create a reserve which we could draw on during dull times. There is no justification in dull times for reduction of prices so far as cost is concerned.

MR. THAYER: There are a number of machines that might be put through not necessarily at a profit but in order to take up part of the overhead charges. How to maintain your organization during dull periods is a pretty important question in a large plant. Sometimes a considerable proportion of the labor is maintained at an actual loss, simply to hold it. It would be interesting to know about how much we could afford to pay or how much we were actually paying for maintaining that labor.

MR. SCOVELL: The remark that the gentleman has just made suggests something else. I notice that some of you are advertising to your prospective customers that they can save money by using this or that machine which you make. How can your customers intelligently make a comparison between your machine and any other unless they are to go at it in just about the way that I have described?

A MEMBER: Suppose that a certain manufacturer makes a hundred machines one year, and in the following year business is such that he sells just about one hundred machines. How would that affect the cost of those machines, inasmuch as they were not manufactured within the year when they were sold?

MR. SCOVELL: That is an accounting problem. As I see it there is no profit on those one hundred machines until they have been actually sold. I should fix my attention on the year in which they were made in order to determine their cost, and the unearned burden, if there was any, in the shop during that period. I should not be interested at all (in so far as cost of those machines was concerned) in the cost of the shop during the period in which they were sold. If you fill up a factory with finished machines they would be taken in stock at their cost. In the following year you may make a profit by a favorable sale of machines built the previous year and carried over, with or without profitable operation of the year which is then current. In other words, you have one hundred machines made in 1912 carried over into 1913, and you sell them at a profit. That is profit which belongs to 1913; but it is not related to the shop operation in 1913. If, as a question of manufacturing policy to keep up shop organization in 1912, you thought it wise to make this product ahead, let us hope your judgment has been justified in 1913. But you have a new problem as to what you will do with the shop in 1913.

MR. E. T. HENDEE, *Joseph T. Ryerson & Son, Chicago, Ill.*: I notice that on your diagram you show an interest charge on the investment covering buildings, machinery, fixtures, etc., as part of the burden. It has always been our custom to charge, in addition to that, interest on the money used in carrying on the business, that is to say interest on outstanding accounts, stock, etc., and it would seem to me that this charge could be considered just as legitimate as would interest on the building investment.

MR. SCOVELL: I agree with you.

MR. HENDEE: You didn't say that.

MR. SCOVELL: As I tried to have some reasonable limits to my paper, I did not discuss the cost of selling. You may be in a trade where your terms are thirty days; with another man the terms in vogue are ninety days. The beef wholesalers collect once a week, and a restaurant every meal. Now a business which collects once a week is different from a business which carries a line of credit for ninety days, and one of the items of cost of the ninety day business is undoubtedly the capital tied up in the outstanding accounts, but this is not a manufacturing cost. If you have in stock one hundred machines that cost you one hundred dollars apiece, then you have $10,000 tied up in finished stock. If you carry a similar amount of stock in finished parts, that is also one of the costs of doing your business, and you should make a charge accordingly against the selling expenses.

MR. E. R. NORRIS, *Westinghouse E. & M. Co., Pittsburgh, Pa.*: I would like to ask the gentleman a question. During slack time, time of depression, when you have a great many machines idle, possibly machines doing a similar class of work but with different overhead—for instance, one machine with an overhead of one dollar and another with an overhead of fifty cents—would you recommend using the cheap machine and letting the high-priced overhead machine stand idle? In other words, it might be possible to do the work in less time on the high-priced machine which would naturally carry a larger overhead, but it would be better to use the machine with less overhead from a cost standpoint; now which would you use?

MR. SCOVELL: That is a decidedly practical question. It is a great deal like choosing an automobile for a trip on Sunday afternoon, whether you are going to use one that you bought at a bargain for $1,250, or another that cost you $4,000. Theoretically it costs you more to run a higher priced machine; but if you have both machines idle it is a practical shop problem. The actual running time required for the job should decide the question as to whether you would use one or the other. The choice might become unimportant from the point of view of cost, it might be altogether a question of expediency. You might be whitewashing that part of the shop and would not want to work over the tool.

MR. JAMES N. HEALD, *Heald Machine Co., Worcester, Mass.*: Probably the answer to that, in the case of regular manufacturing where you didn't have to guess quickly, would be arrived at by adding the direct labor cost to the overhead burden which comes on that machine. For instance, the machine having the lower burden might be an older type of machine that would increase the number of hours of labor required so that the cost would be higher than with the machine with the more expensive rate, but which would cut the time considerably owing to its increased efficiency. The true answer is the sum of those two elements, in any case.

With regard to the remarks made by my friend, Mr. Alden, who opened the discussion in regard to the selling price as com-

pared to the cost, I am inclined to think that while the cost system is the basis, the selling price may not be related so very closely to the cost. Of course we all know that there are lots of elements besides manufacturing cost to be considered. There is a good deal of money spent in selling, for advertising, direct representation, commissions to dealers, and traveling expenses, all of which have a great deal to do with fixing upon the selling prices.

Then the progressiveness of a concern makes a difference. If you are pushing direct representation with demonstrators and taking large space in the trade papers, the selling cost must be affected correspondingly.

Furthermore, if you are determined to be in the lead and to make continuous advances and improvements in your product, bring out new designs and add new lines, and still wish to pay your bills and earn dividends, you have got to have your selling price hign enough to allow for this. The selling price is therefore made up of a larger number of elements. I think the gentleman who opened the discussion desired to make the point that it did not particularly matter to him whether he had an exact division between the earned burden and the unearned burden provided he knew what it was costing him during the year to produce the goods, and he was interested in getting the selling price high enough to be sure that those expense charges were all paid. But the writer of the paper desires to show that this division becomes valuable in correctly showing the true amount of use of any given kind of equipment during a certain period, and if, for instance, there should be a flurry in the lathe department so that apparently more lathes are needed, it is mighty convenient to be able to look back and see that for a long time there have been many of them standing idle, so that a little overtime work or some similar temporary scheme would care for the present need, and the purchase of additional machines is really unnecessary.

Therefore a correct and scientific balancing-up of equipment is made easy, which is an essential feature of official and economical management.

MR. SCOVELL: I appreciate very much, gentlemen, the interest you have shown in this subject. I am pleased that so many have taken part in the discussion.

PRESENT TRENDS IN COST ACCOUNTING*

When you ask me to comment on the trend in factory cost accounting, my thoughts naturally go back over the twenty years in which this subject has been of direct interest to me. At the beginning of that period only two kinds of cost accounting were in general use.

* A letter replying to a request from Factory magazine for comment on recent development in cost accounting—appearing in the January, 1926, Factory and reprinted by their courtesy.

The most common form was process or average costs, which have survived to a considerable extent to this day. Under certain conditions process costs are still serving their purpose fairly well, with one important exception which I shall mention later.

The other kind of costs, then being secured by some painstaking manufacturers, were accumulated charges on individual jobs or individual orders. Job costs merely tally up the items of cost which go into a particular manufactured article.

In the first twenty years of this century thousands of manufacturers installed job-cost systems, which were a considerable improvement over their previous cost practice. In a good many cases, however, they found that the clerical expense involved in keeping up a job cost system was not warranted by the results secured, and a good deal of cost accounting undertaken on this basis was given up, sometimes without very much regret. Job costs still have a limited application and are of great importance where they are really needed, as for a contractor or anyone making special orders, although in some such cases the estimate is accurately determined and is the basis for the sale.

These determined efforts to secure better costs served in many cases, however, to show the interested executives that whatever they might accomplish towards greater accuracy in the application of material and labor costs would amount to very little unless they could get a comparable accuracy in the analysis, distribution, and application of burden. Although the importance of burden as a factor in cost is now generally recognized, there are still thousands of manufacturing plants in which the burden analysis is not yet adequate, and a great deal of work in this particular field remains to be done.

Burden analysis is really the budgeting of those operating expenses of a plant which are not included in the outlay for product materials and for direct labor. It is an important part of the general movement for budgeting in business, and will probably receive continued attention.

Moreover, this idea of budgeting business expense, with particular reference to burden analysis, is an important part of the most significant recent developments in the whole field of cost accounting, namely, the determination of cost standards, made up of material, labor, and burden. A cost standard, defined in simplest terms, is merely a specification of materials, the work to be done thereon, and a schedule of the cost of these items of material and labor one by one.

Manufacturers are only beginning to appreciate the significance of standard costs, and beyond any doubt next year and each year thereafter will see more and more attention given to standard costs, with a correspondingly better appreciation of their value and significance in management. Material specifications must necessarily be accurately known for any manufactured product. Labor costs are constantly becoming better and better defined, either in

the form of piece rates or as unit costs worked out through job analysis. It is only logical that burden analysis should be made precise, so that this third factor of cost may be as accurate as the other two.

When standards have been well defined for materials, labor, and burden, it is possible to get a new kind of executive control over costs, and in most cases by very much less clerical effort than is involved in other methods.

Standard costs, furthermore, lend themselves to combination by departments, so that an executive can get a cross section of his factory in terms of cost reduction which is hardly to be attained in any other way. If the results are unsatisfactory, standard costs lend themselves to a further prompt analysis which is extremely useful. No doubt this advantage will be realized by more and more business executives in the near future.

Finally, the difference between average costs and standard costs should be clearly understood. The outstanding weakness of average costs is that they are said to go up when volume goes down, and to go down when volume goes up. Standard costs, on the other hand, absorb designated standard amounts of labor and burden as well as material, and any expense incurred for labor and burden which is not absorbed at the standard rates is a deviation from standards, or an excess, which requires analysis and usually demands executive attention.

To show how standard costs tie in with a budget program in a manufacturing plant, it is far better to say that if a department or a factory has a normal capacity of 10,000 units, for example, and if only 8,500 units are made, the burden capacity for 1,500 units will not be utilized, than it is to say that if only 8,500 units are made, the cost will be higher. As a matter of fact, the cost per unit is no more if only 8,500 units are made, and the outstanding fact is that 15 percent of the factory capacity is unutilized.

This trend of analysis of the elements of manufacturing cost has naturally led to a similar analysis of sales and selling expenses, with a marked tendency in many industries to scientific analysis of market conditions and sales possibilities. Cost of goods sold by lines, and by territories, when linked with market possibilities and a knowledge of manufacturing capacity, round out a co-ordination of cost information that is essential for executive and financial administration.

Throughout all this development there has also come a new appreciation of the importance of organization, and of the training, development, and proper compensation of the individual.